SUPER SONIC GAS LIFT TOOL DELAWARE PILOT TEST TO ASSESS PRODUCTION IMPROVEMENT AND GAS INJECTION REDUCTION

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ABSTRACT

Interest in the Super Sonic Tool (SST) was generated by it's theorical ability to improve drawdown and reservoir inflow, and the potential to reduce injection gas requirements by up to 40%. Its streamlined design enables easy integration into the existing completion, requiring no wellhead modifications or downtime, making it a practical solution that does not require a MOC. In addition, other field deployments made by the vendor in the Permian Basin seemed to demonstrate its effectiveness. For example, in the Delaware Basin, the tool achieved a 12% production increase while reducing lift gas consumption by 250 MSCFD. Similarly, in the Midland Basin, it delivered a 15% production boost with significant gas savings. The SST was pilot tested for wells waiting for conversion to Plunger Assisted Gas Lift (PAGL) to confirm its ability to provide a low-cost, through-tubing method to boost production and reduce gas requirements. This paper presents the results of a 4-well pilot test conducted in Delaware. This presentation details the findings of these pilot projects and lessons learned. The best response was a 35% uplift in oil production confirmed via a surface multiphase meter.

INTRODUCTION

Historically Rod Pump and ESPs are used for Artificial Lift (AL) in the Permian. Currently 95% of wells are on AL and 85% of current BOE production is from AL. Gas Lift (GL) has emerged as a preferred Artificial Lift (AL) technology in the Permian Basin. Gas Lift (GL) use has increased over the past 10 years, with 52% current BOE production from GL wells and 47% new wells to be GL wells this year. Annular Gas Lift (AGL) & High-Pressure Single-Point (HPSPGL) now compete with ESPs with lower cost, more reliable and high initial rates. As GL wells age, operators are looking at late-life AL alternatives, such as PAGL and Gas Assisted Plunger Lift (GAPL) to reduce gas injection and improve overall lift efficiency. However, conversion to these plunger-based late-life AL systems has been slow and somewhat costly, often requiring surface modifications through a Management of Change (MOC) process and, in some cases, a workover. The number of wells waiting to be converted to plunger alternatives is typically more than can be accomplished during a year due to budget and manpower constraints. For wells waiting for conversion, the Gas Lift Production Enhancement Tool or SST was pilot tested to confirm its ability to provide a low-cost, through-tubing method to boost production and reduce gas requirements. This paper presents the results of a 4-well pilot test conducted in the Delaware.

Artificial Lift Map provides a general indication of preferred lift type. A plot of Gas Lift Ratio (GLR) versus Liquid Flow Rate (QL) provides the best intuitive display of AL operational envelopes. Late-life lift type transitions can be defined based on technical and/or economic limits. The guardrails are for PAGL: QL < 300 BLPD, GLR < 5,000 scf/BL and GAPL: QL < 100 BLPD, GLR < 10,000 scf/BL. The vendor proposes the guardrail for SST: QL<2000 BLPD, GLR<10,000 SCF/BL. Most new horizontal wells are not suitable for rod pumping due to crooked holes and slugging; so PAGL/GAPL use expanding. A low-cost way to increase rates and drop P_{bh} is attractive for the 1-2 year period before conversions can be completed/funded. Reduced compression is also attractive, if reductions similar to PAGL/GAPL can be shown.

SUPER SONIC GAS LIFT TOOL

The SST is a novel application of gas dynamics utilizing a patented convergence-divergence design based on the Venturi principle. The SST uses existing injected gas to create a suction to enhance oil production via venturi effect. Injected gas reaches supersonic speed at the converging-diverging nozzle to lower the pressure, and the produced fluid then mixes with the injected gas in a diffuser transferring that energy to the fluid-gas mixture. Also, this tool improves the ability of the injected gas to lift liquids by reducing the slippage between the gas and liquid phases downstream of the tool. The tool is installed through-tubing via slickline and placed over the active GL valve, so the injected gas is forced through the tool as the power fluid.

PILOT DESCRIPTION

To confirm/validate performance of this tool, a pilot project was undertaken in the Delaware Basin. After careful review of multiple candidates, 4 wells were selected. The SST was first installed in 2 wells and then installed in an additional 2 wells with a Multiphase Meter (MPM) to confirm baseline well performance and uplift. The tool was installed via slickline in less than one day for each well.

The SST is installed at the point of gas injection. Four slickline runs are used to set the SST across the active GL valve or a single run used with new GL completion or redesign. The SST should be placed across the wells operating point, ideally on wells not "multi-pointing." The use of CO_2 Tracer is an effective way to verify the Point-of-Injection (POI) and it was used in this pilot. CO_2 tracers were shown to be critical in confirming the gas injection location (active valve) which is essential for tool operation. A CO_2 tracer is a simple yet highly effective process to diagnose and optimize GL systems. An expert model identifies the GL Lift injection point and ultimately the performance of the GL well. A controlled amount of liquid CO_2 is injected into the lift gas stream. The CO_2 slug travels through the casing-tubing annulus, interacting with GL valves, tubing leaks, and injection points. Upon returning to the surface, CO_2 concentration is measured to identify GL inefficiencies and other downhole issues. For example, in one pilot well, the tool was installed across the wrong valve and later moved to the correct position based on a CO_2 tracer survey. The importance of accurate well testing in a bulk-test system was also a lesson learned from this pilot as was the value of a MPMs when continuous real-time metering is needed to quantify uplifts in the 10-35% range.

PILOT RESULTS

Pilot well A - 14 BOPD oil uplift and 300 Mscf/day gas uplift; some multi-pointing is suspected.

Pilot Well B - Production data initially not showing production gains, tool installed in the wrong location. Repositioned the tool and production gains trend in the right direction with 31 BOPD oil uplift.

Pilot Well C - 30 BOPD uplift observed, but several weeks before complete injection through SST is achieved. Compressor issues have dropped well rates in 2025.

Pilot Well D - slight initial uplift observations, but multi-pointing evident. Gas injection variability later in the test, finally, gas was just circulating through upper valves, i.e. not the SST.

CONCLUSIONS

A production increase was observed when the injected gas passes through the SST. Some indication of reduce gas requirement seen, but compression was too unstable to fully demonstrate. The pilots showed that it is critical to know the active valve for the SST to provide benefit; multi-pointing and holes in tubing greatly reduce the benefits. Conducting pilots in many areas of the Delaware is difficult due to compressor and takeaway issues. The pilot was able to demonstrate a positive benefit for this technology and moving to install in additional wells